REMARKS

Claims 1-10, 13, 15, 17, and 19-20 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Diepstraten (U.S. Patent No. 5,602,896). The rejection stated:

> "In regard to claim 1, note Diepstraten discloses the use of a method for producing a composite digital image, comprising the steps of providing a plurality of partially overlapping source digital images having pixel values that are linearly or logarithmically related to scene intensity (column 6, lines 34-44), computing a radial exposure transform to compensate for exposure fall off as a function of the distance of a pixel from the center of the digital image (column 8, lines 25-29; the images are compensated for vignetting), modifying the source digital images by applying a radial exposure transform to one or more of the source digital images to produce adjusted source digital images (column 8, lines 25-29; the images are compensated for vignetting), and combining the adjusted source digital images to form a composite digital image (column 9, lines 56-58). Therefore, it can be seen that the Diepstraten device lacks the step of determining the focal length of the source digital images by analyzing the exposure falloff in at least one overlapping region of said source digital images. Official notice is taken that the concepts and advantages of using the focal length to calculate the radial exposure transform are notoriously well known and expected in the art. Therefore, it would have been obvious to one of ordinary skill in the art to modify the Diepstraten device to include the use of the focal length to calculate the radial transform in order to compensate for falloff caused by the lens system."

The rejection also stated:

> 'Applicant argues, with respect to claim 1, in particular the limitation that was previously in now canceled claim 14, of "determining the focal length of the source digital images by analyzing the exposure falloff in at least one overlapping region of said source digital images", that the official notice does not relate to a step of determining focal length, but rather to computing the radial exposure transform from the determined focal length. However, the examiner points out that in order for the radial

transform to be computed using the determined focal length, then the focal length is inherently determined before computing the radial transform.'

Claim 1 states:

> 1. A method for producing a composite digital image, comprising the steps of:
>
> providing a plurality of partially overlapping source digital images having pixel values that are linearly or logarithmically related to scene intensity, said source digital images having overlap regions wherein pixels of said source digital images correspond in scene content, said source digital images differing in scene content outside said overlap regions;
>
> determining the focal length of the source digital images based upon one or more sets of corresponding pixel values of the source digital images in said overlap regions;
>
> computing from the determined focal length, a radial exposure transform to compensate for exposure fall off as a function of the distance of a pixel from the center of the digital image;
>
> modifying the source digital images by applying the radial exposure transform to one or more of the source digital images to produce adjusted source digital images; and
>
> combining the adjusted source digital images to form a composite digital image by blending said overlap regions.

Claim 1 is supported by the application as filed, notably the original claims and at Figures 4A-4B, 6-7, and 11; page 1, lines 10-13; page 8, lines 7-9; page 13, lines 5-11; page 9, lines 1-10 (generally see page 8, line 7 to page 11, line 2). Language moved from Claim 1 to added Claim 22 was addressed in the rejection as being "inherently determined". This allows for separate discussion of different issues as to the official notice taken in the rejection as to Claim 1. Claim 22 is discussed below. Claim 5 was cancelled and Claim 4 was amended to maintain a constant number of claims.

Claim 1 requires determining the focal length of the source digital images based upon image information provided by one or more sets of corresponding pixel values of the source digital images in overlap regions. This

language is similar to language in allowed Claims 18 and 21, which state, in relation to the function:

> "wherein I_i" and I_i' are exposure values at points in the digital images at the overlapping region"

Diepstraten, in contrast, calculates correction values that are "essentially independent" of image information:

> "The values of column and line gain factors are essentially independent of the image information of the sub-images. Consequently, the values of column and line gain factors can be derived from the reference images so as to be stored in a memory." (Diepstraten, col. 4, lines 14-15)
>
> "The reference images may be special-purpose images wherefrom column and line gain factors are derived whereby accurately corrected composite images can be obtained in many different circumstances. The first and second reference images may furthermore be images containing the same image information." (Diepstraten, col. 4, lines 22-28)
>
> (The office action, in relation to original Claim 5, indicated that the column and line gain factors of Diepstraten were used in a scene independent transform.)

The official notice taken in the rejection (discussed further below) relates to "the concepts and advantages of using the focal length to calculate the radial exposure transform". This does not address determining focal length based upon corresponding pixel values of the source digital images. (See Application, Figure 6 and page 7, lines 3-12; in which focal length and light falloff are discussed in relation to a single source image.) Thus, the combination of Diepstraten and the official notice would not teach or suggest more than Diepstraten alone.

Claim 1 also requires that the source digital image:

> "have overlap regions wherein pixels of said source digital images correspond in scene content, said source digital images differing in scene content outside said overlap regions"

and that the adjusted source digital images are combined to form a composite digital image by blending the overlap regions.

In Diepstraten, in contrast, entire sub-images are blended together. (Diepstraten, col. 7, lines 1-7; also see col. 1, line 39 to col. 2, lines 25)

Claim 1 requires computing "a radial exposure transform to compensate for exposure fall off as a function of the distance of a pixel from the center of the digital image" and "modifying the source digital images by applying the radial exposure transform to one or more of the source digital images to produce adjusted source digital images". In relation to Claim 1, the rejection cites Diepstraten and states:

> "modifying the source digital images by applying a radial exposure transform to one or more of the source digital images to produce adjusted source digital images (column 8, lines 25-29; the images are compensated for vignetting)".

This statement, in the rejection, is based upon an assumption that Diepstraten's compensating for vignetting is the same as applying a radial exposure transform to compensate for exposure fall off as a function of the distance of a pixel from the center of the digital image. This assumption is incorrect. The term "vignetting" is not limited to radial exposure fall off and, in Diepstraten the compensation provided is not a radial transform.

U.S. Patent No. 5,434,902 to Bruijns (hereafter "Bruijns") teaches compensation for vignetting phenomena in an apparatus very similar to that of Diepstraten. (Compare Bruijns Figure 4b and Diepstraten Figure 1 and related discussion.) Bruijns describes vignetting that varies radially and then describes vignetting that varies along lines of the image:

> "Vignetting phenomena have often the property that the associated attenuation coefficients depend on a position of a pixel in the image as a function only of a radial distance between the relevant pixel and a centre of the image." (Bruijns, col. 3, lines 46-50)
>
> "Vignetting phenomena have often the property that the associated attenuation coefficients vary along lines in the image and that said variation is substantially the same along each parallel line in the image." (Bruijns, col. 3, lines 64-67)

Bruijns also describes other vignetting:

> "In medical x-ray radiography various further origins of vignetting in an x-ray image are known, e.g. variations in intensity in an x-ray beam emitted

by an x-ray source, the geometry of the x-ray detection screen, e.g. an input screen of an x-ray image intensifier or the substantially cylindrical shape of a patient to be examined. The vignetting of the x-ray image is transferred to a visible image when the x-ray image is transformed into a visible image". (Bruijns, col. 6, lines 52-60)

As earlier noted, the equipment disclosed in Diepstraten is very similar to that of Bruijns. (Both patents have the same assignee and are close in time period.)

The usage of vignetting to refer to phenomena other than radial light fall off is not limited to Bruijns. International (PCT) Patent Publication No. WO 02/056055 A2 by Lanza et al. (hereafter "Lanza") states:

'At the same time, any mask with finite thickness will invariably block at least some oblique rays that should pass through a mask opening. Further, as the mask thickness increases, less and less γ rays will actually pass though, particularly in the case of near-field imaging where a substantial amount of the emitted radiation impinges on the mask at a non-zero angle. This effect is observable in the phenomenon known as "vignetting," where, as mask thickness increases, features of the projected image (starting with small holes around the periphery of the image) begin to disappear.' (Lanza, page 24, lines 1-8)

U.S. Patent No. 5,812,629 to Clauser (hereafter "Clauser") similarly states:

"A Bucky grid is included in an x-ray imaging apparatus between the object and the detector to attenuate scattered x-rays [citation omitted]. A Bucky grid is inherently thick. Its structure is similar to that of a louver or venetian blind, with said louvers made of lead. Its operation is also similar. Its louvers are either all parallel or are "fanned" to match the x-ray incidence-angle. It selectively attenuates scattered x-rays by vignetting, i.e. it absorbs obliquely incident x-rays and allows passage of x-rays that are incident nearly parallel to its louvers." (Clauser, col. 5, lines 51-61)

In Diepstraten, the vignetting compensation is described:

"Prior to the start of the iteration, the shift register is initialized to the value 1, so that for the column gain factor whereto the amplifier is adjusted by the correction unit the differences between column average values of brightness values of the first and the second sub-image are just

compensated; this means that the line gain factors compensate vignetting in the direction of the image lines." (Diepstraten, col. 8, lines 23-29; emphasis added)

"A difference between brightness variation in the sub-images in the column direction which do not relate to image information (vignetting difference in the image column direction) is compensated by multiplication by the line gain factors." (Diepstraten, col. 10, lines 28-32; emphasis added)

"The vignetting difference in the image line direction is compensated by multiplication by the column gain factors." (Diepstraten, col. 10, lines 36-38)

In Diepstraten, neither the vignetting nor the compensation is described as being radial.

The official notice finding of the rejection of Claim 1 is dependent upon Diepstraten teaching use of a radial exposure transform. The rejection cited Diepstraten, column 8, lines 25-29, "the images are compensated for vignetting", for this position. As earlier discussed, the quoted language, in Diepstraten, describes compensating gain factors for "vignetting in the direction of the image lines" and Diepstraten elsewhere refers to compensating gain factors for "vignetting difference in the image column direction". (Diepstraten, col. 8, line 28; col. 10, lines 31-32) Use of a radial exposure transform is not taught and, arguably, is taught against by the disclosed compensation procedure. Diepstraten states:

"(vignetting difference in the image column direction) is compensated by multiplication by the line gain factors." (Diepstraten, col. 10, lines 30-32; emphasis added)

"The vignetting difference in the image line direction is compensated by multiplication by the column gain factors." (Diepstraten, col. 10, lines 36-38)

As a result, the official notice is a finding of the concepts and advantages of something unrelated to the cited reference and motivation for combining Diepstraten and the official notice fails.

Even if Diepstraten had taught use of a radial exposure transform to correct for vignetting in the form of radial exposure falloff (which it does not),

there are additional problems with the official notice. The rejection improperly relies upon the official notice to establish otherwise unstated "concepts and advantages" of a particular procedure in a complicated art. The MPEP states:

> 'Official notice without documentary evidence to support an examiner's conclusion is permissible only in some circumstances. While "official notice" may be relied on, these circumstances should be rare when an application is under final rejection or action under 37 CFR 1.113. Official notice unsupported by documentary evidence should only be taken by the examiner where the facts asserted to be well-known, or to be common knowledge in the art are capable of instant and unquestionable demonstration as being well-known. As noted by the court in In re Ahlert, 424 F.2d 1088, 1091, 165 USPQ 418, 420 (CCPA 1970), the notice of facts beyond the record which may be taken by the examiner must be "capable of such instant and unquestionable demonstration as to defy dispute" (citing In re Knapp Monarch Co., 296 F.2d 230, 132 USPQ 6 (CCPA 1961)). In Ahlert, the court held that the Board properly took judicial notice that "it is old to adjust intensity of a flame in accordance with the heat requirement."' (Manual of Patent Examining Procedure, Section 2144.03A; emphasis added)
>
> 'It would not be appropriate for the examiner to take official notice of facts without citing a prior art reference where the facts asserted to be well known are not capable of instant and unquestionable demonstration as being well-known. For example, assertions of technical facts in the areas of esoteric technology or specific knowledge of the prior art must always be supported by citation to some reference work recognized as standard in the pertinent art. In re Ahlert, 424 F.2d at 1091, 165 USPQ at 420-21. See also In re Grose, 592 F.2d 1161, 1167-68, 201 USPQ 57, 63 (CCPA 1979) ("[W]hen the PTO seeks to rely upon a chemical theory, in establishing a prima facie case of obviousness, it must provide evidentiary support for the existence and meaning of that theory."); In re Eynde, 480 F.2d 1364, 1370, 178 USPQ 470, 474 (CCPA 1973) ("[W]e reject the notion that judicial or administrative notice may be taken of the state of the art. The facts constituting the state of the art are normally subject to the possibility of rational disagreement among

reasonable men and are not amenable to the taking of such notice.").'
(Manual of Patent Examining Procedure, Section 2144.03A; emphasis in original)

The "concepts and advantages" of the official notice are not capable of instant and unquestionable demonstration as being well-known, since it cannot be certain what is meant by that term. It is certain that the official notice is improperly directed to the state of the art in a complex technical field. The above discussion shows that vignetting and compensations for vignetting are complicated. The concepts and advantages of use of a particular compensation depend upon a particular use. For example, Bruijns (U.S. 5,434,902) states:

"Vignetting phenomena may depend on various adjustments of the imaging system, e.g. the setting of apertures. Therefore, so as to sustain correction for vignetting, a different set of correction factors may have to be chosen upon variation the adjustments of the imaging system."
(Bruijns, col. 4, lines 18-23)

Applicants therefore demand that authority be produced in place of the official notice or that the rejection be withdrawn.

Added Claim 22 is allowable as depending from Claim 1 and as follows. Claim 22 is supported by the application as filed, notably the original claims.

The rejection stated in relation to language in added Claim 22:

'Applicant argues, with respect to claim 1, in particular the limitation that was previously in now canceled claim 14, of "determining the focal length of the source digital images by analyzing the exposure falloff in at least one overlapping region of said source digital images", that the official notice does not relate to a step of determining focal length, but rather to computing the radial exposure transform from the determined focal length. However, the examiner points out that in order for the radial transform to be computed using the determined focal length, then the focal length is inherently determined before computing the radial transform.'

Claim 22 states:

22. The method of claim 1 wherein said determining further comprises analyzing the exposure falloff in at least one of said overlap regions.

The rejection argues that the feature of Claim 22 is inherently determined before computing the radial transform. It is not apparent whether this inherency is argued to be within Diepstraten or the official notice. As to the latter, reliance upon an inherent feature of an office notice is incompatible with the requirement that official notice is limited to facts capable of instant and unquestionable demonstration. (See above quotation of MPEP 2144.03A) Diepstraten, unlike Claim 22, does not disclose analyzing overlap regions of source digital images, in which the pixels of the source digital images correspond in scene content in the overlap regions and differ in scene content outside the overlap regions. In Diepstraten, the gain factors are determined based upon differences between sub-images or are fetched from memory. (Diepstraten, col. 6, lines 39-43; col. 7, lines 20-22)

Claims 2-4, 6-10, 13, 15, and 17 are allowable as depending from Claim 1 and as follows.

The rejection stated in relation to Claim 2:

> "In regard to claim 2, note Diepstraten discloses the use of a step of applying a linear exposure transform to one or more of the source digital images prior to combining the adjusted source digital images to produce adjusted source digital images having pixel values that closely match in an overlapping region (column 6, lines 40-45: the images are compensated based on the differences between the images in order to match the two and composite them together)."

Claim 2 states:

> 2. The method of claim 1, further comprising the step of applying a linear exposure transform to one or more of the source digital images prior to combining the adjusted source digital images to produce adjusted source digital images having pixel values that closely match in an overlapping region.

Claim 2 requires a step of applying a linear exposure transform to one or more of the source digital images, in addition to the features of Claim 1. The cited portion of Diepstraten relates to the correction unit:

> "A correction unit 5 corrects the electronic image signal for the composite image for differences between the signal levels of the individual image

sensors, in as far as these differences do not relate, or hardly relate, to image information in the optical image." (Diepstraten, col. 6, lines 40-45)

In Diepstraten, the correction unit 5 provides the compensation for vignetting:

"The correction unit 5 is coupled to the control unit 26 and to the high-voltage power supply 24 in order to supply column and line gain factors for different settings so as to form corrected brightness values for the composite image." (Diepstraten, col. 6, lines 57-61)

"(vignetting difference in the image column direction) is compensated by multiplication by the line gain factors." (Diepstraten, col. 10, lines 30-32)

"The vignetting difference in the image line direction is compensated by multiplication by the column gain factors." (Diepstraten, col. 10, lines 36-38)

The proposed combination of Diepstraten and the official notice would replace the linear exposure transform with a radial exposure transform. This would eliminate the feature relied upon to reject Claim 2.

The rejection of Claim 3 states:

"In regard to claim 3, note Diepstraten discloses the use of a method for producing a composite digital image as claimed in claim 1. Therefore, it can be seen that the Diepstraten reference fails to disclose that the radial exposure transform includes a cos4 dependence on the distance from the center of the image. Official notice is taken that the concepts and advantages of using a transform to compensate for falloff using the cos4 law of illumination falloff is notoriously well known and expected in the art. Therefore, it would have been obvious to one of ordinary skill in the art to modify the Diepstraten device to include the use of a radial exposure transform includes a cos4 dependence on the distance from the center of the image in order to correctly compensate for image falloff."

Claim 3 states:

3. The method claimed in claim 1, wherein the radial exposure transform includes a $\cos^4$ dependence on the distance from the center of the image.

Applicants demand that authority be produced in place of the official notice or that the rejection be withdrawn. In support of this demand, Applicants cite

Bruijns (U.S. 5,434,902), which indicates that compensating vignetting as a function of radial distance is complicated and unsuitable for official notice:

> "When the correction factors for compensating vignetting are a function of the radial distance, such a function can often be fairly well approximated by a mathematical function of the radial distance, said mathematical function having further parametric dependencies. In particular, correction factors that are a function of the radial distance can be calculated to good approximation by functions representing e.g. a Gaussian or a Lorentzian profile, where the height and width of such profiles can be varied by varying the values of corresponding parameters on which said functions depend."

Amended Claim 4 is allowable on the grounds discussed above in relation to Claim 2.

Claim 19 has been amended in the same manner as Claim 1 and is supported and allowable on the same basis.

Claim 20 is allowable as depending from Claim 19 and on the grounds discussed above in relation to Claim 2.

Claim 11 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Diepstraten in view of Inoue et al. (US Patent # 5,083,209). Claim 11 is allowable as depending from Claim 2.

Claim 12 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Diepstraten in view of Hirai et al. (US Patent #6,603,928). Claim 12 is allowable as depending from Claim 2.

It is believed that these changes now make the claims clear and definite and, if there are any problems with these changes, Applicants' attorney would appreciate a telephone call.

In view of the foregoing, it is believed none of the references, taken singly or in combination, disclose the claimed invention. Accordingly, this application is believed to be in condition for allowance, the notice of which is respectfully requested.

Respectfully submitted,

Attorney for Applicant(s)
Registration No. 30,700

Robert Luke Walker/amb
Rochester, NY 14650
Telephone: (585) 588-2739
Facsimile: (585) 477-1148

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